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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/076,915	TONKOVICH ET AL.	
	Examiner	Art Unit	
	JENNIFER A. LEUNG	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 September 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30 and 75-101* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *5,13,15-23,85,96 and 98-100* is/are allowed.

6)☒ Claim(s) *1-4,6-12,24-30,75,77-79,84,86-95,97 and 101* is/are rejected.

7)☒ Claim(s) *9,10,14,76,78 and 80-83* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed on September 29, 2008 has been considered. Claims 31-74 are cancelled. Claims 1-30 and 75-101 are under consideration.

Claim Objections

2. Claims 9, 10, 14, 76 and 78 are objected to because of the following informalities:

In claim 9: "the flow path" (line 4) should be changed to --each flow path in said plurality of flow paths--, for consistency in claim terminology.

In claim 10: --a-- should be inserted before "continuous second flow path" (lines 2-3);

"the first flow path and second flow path and third flow path" (lines 12-13) should be changed to --the first flow path, ~~and~~ the second flow path and the third flow path--; and

the second "and" (line 22) should be deleted.

In claim 14: "the unit operation comprises distillation" should be changed to --the separating comprises distillation--, as set forth in claim 13, lines 19-20.

In claim 76: "the unit operation comprises distilling" should be changed to --the separating comprises distilling--, as set forth in claim 13, lines 19-20.

In claim 78: "the at least one flow path" (line 1) should be changed to --each flow path in said plurality of flow paths--, for consistency in claim terminology.

Appropriate correction is required.

Double Patenting

3. Claim 76 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 14.

When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. MPEP § 706.03(k).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 84 and 86 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 84, it is unclear as to how the second unit operation can be "selected from the group consisting of distilling, reacting, adsorbing, compressing, expanding, separating, absorbing, vaporizing, condensing, and combinations of these" (lines 22-24), since the claim is now amended to recite "the second flow path comprises a catalyst metal on an oxide support" (lines 29-30). The catalyst metal limits the second unit operation to "reacting". Claim 86 depends from rejected claim 84.

Claim Rejections - 35 USC § 102 and § 103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-4, 6-9, 75, 78, 79, 94 and 95

5. Claims 1-3, 6-9, 75, 78, 79, 94 and 95 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818) in view of Yamashita (JP 2000-329490).

Regarding claims 1, 8 and 9, Bottcher et al. (see FIGs. 1-5; column 1, line 50 to column 2, line 49) discloses process of making a device (i.e., a permeable structure) for conducting a unit operation comprising:

stacking a plurality of shims (i.e., sheets **2**) such that a plurality of continuous flow paths are formed through the shims (e.g., continuous channels **1**, formed by aligned openings **7**); wherein the plurality of continuous flow paths **1** extend in a direction substantially parallel to shim **2** thickness (see FIGs. 1, 2); wherein the plurality of continuous flow paths **1** are connected to a common header (see, e.g., column 2, lines 9-16); wherein the plurality of shims comprises at least three adjacent shims **2** (see column 1, lines 31-35) through which the flow path **1** is formed and wherein a straight, unobstructed line is present through the flow path **1** in said at least three shims **2** (see, e.g., FIGs. 1, 2);

wherein the flow paths **1** are defined by the borders of the aligned apertures **7** in said at least three shims **2**; wherein the three shims are configured such that a unit operation can be performed on a fluid in the flow path in which the straight, unobstructed line is present in said at least three adjacent shims (e.g., heat exchanging, condensing, reacting, etc. with fluids; see column 2, lines 49-55); and

bonding the shims to form the device capable of performing the unit operation on a fluid (see column 2, lines 32-36).

The process of making a device as disclosed by Bottcher et al. is the same as the instantly claimed process, but Bottcher et al. is silent as to the borders of apertures **7** having a circumference at least 20% populated by edge features.

Yamashita et al. (see FIGs. 2, 3) teaches a process of making a device by stacking a plurality of shims (i.e., plates **11(1)**, **11(2)**... **11(n)**; or plates **21(1)**, **21(2)**... **21(n)**), wherein a continuous flow path extends in a direction substantially parallel to the shim thickness, and, in particular, the continuous flow path is defined by the borders of apertures **12b**, **22b**, said borders having a circumference at least 20% populated by edge features (i.e., a saw tooth configuration or a wave configuration toothing). (see also sections [0012]-[0013]) and claim 7).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apertures in the process of Bottcher et al. with a circumference at least 20% populated by edge features, because the edge features increase the surface area of the continuous pathway, and thereby increases heat transfer within the device, as taught by Yamashita et al. (see, e.g., section [0012]).

Regarding claims 2 and 78, Bottcher et al. discloses that the aperture 7 comprises a shape

selected from the group consisting of circles, ovals, irregular shapes, and rectangles with rounded corners (see FIGs. 1-5). In any event, the recitation of a specific shape does not confer patentability to the claim, since changes in shape involves only ordinary skill in the art. *In re Dailey* 149 USPQ 47, 50 (CCPA 1966); *Glue Co. v Upton* 97 US 3, 24 (USSC 1878).

Regarding claim 3, Bottcher et al. discloses that the aperture **7** in each of the at least three adjacent shims **2** may comprise a circle (see, e.g., FIGs. 3, 5), wherein the shims **2** are bonded to form the device (see column 2, lines 33-37) comprising a flow path having a cylindrical shape.

Regarding claims 6 and 94, Bottcher et al. discloses that the at least one flow path **1** may be configured such that it does not connect with any other flow paths (see, e.g., FIGs. 1, 2, wherein the flow paths **1** are separate from one another, and pass from a corresponding opening **9** in the top cover plate **5** to a corresponding opening **9** in the bottom cover plate **5**).

Regarding claims 7 and 79, Bottcher et al. further discloses that the centers of the apertures **7** may be offset from the common axis of the row of holes, such that structures can be built up in which the channels formed by the holes obtain a stepped or helical surface, thereby, inherently, defining a static mixer within the flow path (see column 1, lines 36-41 and 63-64).

Regarding claim 75, Bottcher et al. discloses that the flow path **1** is formed by an aperture **7** in each of the at least three adjacent shims **2**, wherein the shape may comprise an irregular shape (see, e.g., holes **7a** in FIG. 3). In any event, the recitation of a specific shape for the apertures does not confer patentability to the claim, since it has been held that changes in shape involves only ordinary skill in the art. *In re Dailey* 149 USPQ 47, 50 (CCPA 1966); *Glue Co. v Upton* 97 US 3, 24 (USSC 1878).

Regarding claim 95, Yamashita et al. (FIGs. 2, 3; sections [0012]-[0013]) and claim 7)

further teaches that the borders of the apertures **12b**, **22b** is at least 50% populated by edge features (i.e., a saw tooth configuration or a wave configuration toothing). Although Yamashita et al. is silent as to whether the edge features cause at least a 1% variation in the diameter of the aperture, the specific percentage of diameter variation is not considered to confer patentability to the claim since the precise percentage would have been considered a result effective variable by one having ordinary skill in the art. Accordingly, one having ordinary skill in the art would have routinely optimized the amount of diameter variation caused by the edge features in the modified process of Bottcher et al. to obtain the desired level of heat transfer efficiency within the device. *In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980), and since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818) in view of Yamashita (JP 2000-329490), as applied to claim 1 above, and further in view of Bottcher et al. (US 5,212,004).

Bottcher et al. '818 discloses that the at least 3 adjacent shims may comprise "different sheet patterns." (see column 1, lines 31-35). Bottcher et al. '818, however, is silent as to the at least 3 adjacent shims being identical. Bottcher et al. '004, however, teaches that a continuous flow path may be formed by stacking 3 adjacent shims that are identical (see column 2, lines 56-62). It would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to configure the at least 3 adjacent shims to be identical in the process of Bottcher et al. '818, in order to allow for the surface ratio of the various flow paths to be varied and thus adapted to meet a particular heat transfer requirement, as taught by Bottcher et al. '004.

Claims 10-12 and 101

7. Claims 10 and 101 are rejected under 35 U.S.C. 102(b) as being anticipated by Symonds et al. (WO 00/34728).

Regarding claim 10, Symonds et al. discloses a process comprising:

stacking a plurality of shims (e.g., perforated plates **26**, **26A**; FIG. 1) such that a continuous first flow path (i.e., a first path defined by a set of vertically aligned slots **36**; FIG. 2), a continuous second flow path (i.e., a second path defined by a set of vertically aligned slots **46**; FIG. 2), and a continuous third flow path (i.e., a third path defined by another set of vertically aligned slots **36**; FIG. 2) are formed through the shims; the first, second and third flow paths being substantially parallel to the shim thickness;

wherein the plurality of shims comprises at least three shims (e.g., as shown in FIG. 1, four shims **26**, or five shims **26A**) through which the first flow path, the second flow path, and the third flow path are formed, wherein a straight, unobstructed line is present through the first flow path (i.e., defined by aligned slots **36**) in said at least three shims, and wherein a straight, unobstructed line is present through the second flow path (i.e., defined by aligned slots **46**) in said at least three shims; wherein the first flow path does not mix with any other flow paths, and the second flow path does not mix with any other flow paths;

bonding the shims **26**,**26A** (i.e., defined by slots **46**) to form a device **10** capable of performing a unit operation on a fluid (see, e.g., page 5, third paragraph);

passing a first fluid **A** (FIG. 1) into the device **10** such that the fluid passes through the first flow path and the third flow path (i.e., each defined by aligned slots **36**);

performing at least one first unit operation on the fluid **A** as it passes through the first

flow path and the third flow path, wherein the unit operation comprises, e.g., reacting (i.e., in the presence of a catalyst packed into the passageways formed by slots **36**; see, e.g., page 3, last paragraph; page 17, fourth paragraph);

passing a second fluid (i.e., via inlet **24**; FIG. 1) into the device **10** such that the fluid passes through the second flow path (i.e., defined by aligned slots **46**) in said plurality of shims **26**,**26A**; and

performing at least one second unit operation on the fluid as it passes through the second flow path, said second unit operation comprising, e.g., heating or cooling (see, e.g., page 3, last paragraph, to page 4, first paragraph; page 11, fourth paragraph);

wherein the first flow path, the second flow path and the third flow path are each in parallel rows, wherein the second flow path is disposed between the first and third flow paths (see, e.g., FIG. 2); wherein heat is exchanged between the first and second flow paths, and heat is exchanged between the third and second flow paths; and wherein the first unit operation (i.e., reacting) is different from the second unit operation (i.e., heating or cooling).

Regarding claim 101, Symonds further discloses that the shims may be configured such that each parallel row comprises plural, parallel flow paths (see FIG. 17; page 22, last paragraph to page 23, second paragraph).

8. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Symonds et al. (WO 00/34728) in view of Yamashita (JP 2000-329490).

Regarding claim 11, Symonds et al. is silent as to the borders of the apertures (i.e., slots **36**; FIG. 2) having a circumference at least 20% populated by edge features. Yamashita et al. (see FIGs. 2, 3) teaches a process of making a device by stacking a plurality of shims (i.e., plates

11(1), **11(2)**... **11(n)**; or plates **21(1)**, **21(2)**... **21(n)**), wherein a continuous flow path extends in a direction substantially parallel to the shim thickness, and, in particular, the continuous flow path is defined by the borders of apertures **12b**, **22b**, said borders having a circumference at least 20% populated by edge features (i.e., a saw tooth configuration or a wave configuration toothing). (see also sections [0012]-[0013]) and claim 7). It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apertures in the process of Symonds et al. with a circumference at least 20% populated by edge features, because the edge features increase the surface area of the continuous pathway, and thereby increases heat transfer within the device, as taught by Yamashita et al. (see, e.g., section [0012]).

Regarding claim 12, Yamashita et al. further teaches that borders of the apertures in at least one of said shims comprises a circumference that is at least 20% populated by edge features (i.e., inner circumference of an opening **12b** comprising a saw tooth, FIG. 2; inner circumference of an opening **22b** comprising a wave configuration toothing, FIG. 3; see also sections [0012]-[0013]) and claim 7), and a smooth border in another of said shims (i.e., inner circumference of an opening **12a**, FIG. 2; inner circumference of an opening **22a**, FIG. 3). It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apertures in the process of Symonds et al. to comprise at least 20% edge features, or a smooth border, on the basis of suitability for the intended use, in order to the desired amount of surface area within the continuous pathway to vary the heat transfer efficiency of the device, as taught by Yamashita et al. (see, e.g., section [0012]).

Claims 24-26, 77 and 97

9. Claims 24-26, 77 and 97 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Bottcher et al. (US 5,657,818) in view of Haswell et al. (Article: *Chemical and biochemical microreactors*).

Regarding claims 24 and 26, Bottcher et al. (see FIGs. 1-5; column 1, line 50 to column 2, line 49) discloses a process comprising:

stacking a plurality of shims (i.e., sheets **2**) such that a continuous flow path is formed through the shims (e.g., continuous channels **1**, formed by aligned openings **7**); wherein the flow path **1** extends in a direction substantially parallel to shim **2** thickness (see FIGs. 1, 2); wherein the plurality of shims comprises at least three shims **2** (see column 1, lines 31-35) through which the flow path **1** is formed;

bonding the shims (see column 2, lines 32-36) to form the device capable of performing a unit operation (see column 2, lines 49-55) on a fluid;

passing the fluid into the device (i.e., via openings **9** in the cover plate 5) such that the fluid passes through the flow path **1** in said shims; and

performing the unit operation on the fluid as it passes through the flow path **1** in which a straight, unobstructed line is present through the flow path **1** in said at least three shims **2** (see, e.g., FIGs. 1, 2).

Bottcher et al. is silent as to whether the flow path **1** may comprise a microchannel, such that the minimum dimension of the flow path is at least 10 μm, and the maximum dimension of the flow path is at most 1000 μm.

Haswell et al., however, teaches the known use of flow paths configured as microchannels for performing chemical and biochemical reactions, with the flow paths having dimensions within the instantly claimed ranges (e.g., 500 μm, page 391, last line in column 1;

700 μm, page 392, column 1; 300 μm wide and 115 μm deep, page 393, column 1).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the continuous flow path in the process of Bottcher et al. with microchannel dimensions, because the microchannel dimensions enables rapid mass and heat transfer to be achieved within the device, thereby providing a higher level of reaction control and reaction manipulation, as taught by Haswell et al. (see page 389, column 2). Furthermore, it has been held that changes in size involve only ordinary skill in the art. *In re Rose*, 220 F.2d 459, 463, 105 USPQ 237, 240 (CCPA 1955).

Regarding claims 25, 77 and 97, Bottcher et al. discloses that the unit operation is selected from the group consisting of chemical reaction, vaporization, compression, chemical separation, distillation and condensation (see column 2, lines 49-55).

Claims 27-30

10. Claim 27-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818).

Regarding claims 27-30, Bottcher et al. discloses a process comprising:

stacking a plurality of shims **2** such that a continuous first flow path (i.e., a channel **1**, defined by aligned openings 7) and a continuous second flow path (i.e., defined by aligned flow spaces **4**) are formed through the shims; wherein the first and second flow paths are substantially parallel to the shim thickness (see FIG. 2; the paths **1** are parallel to the shim **2** thickness; also, the paths **4** are parallel to the shim **2** thickness in the regions between transverse bridges **6**); wherein the plurality of shims **2** include at least three shims through which the first flow path **1** is formed, and wherein a straight line can be drawn

through the flow path in said at least three shims;

bonding the shims **2** to form a device capable of performing a unit operation on a fluid (see column 2, lines 33-55);

passing a first fluid into the device such that the fluid passes through the first flow path **1** in the plurality of shims **2**;

performing at least one unit operation on the fluid as it passes through the first flow path in said plurality of shims **2** (see column 2, lines 49-55);

passing a second fluid into the device such that the fluid passes through the second flow path **4** in said plurality of shims **2**;

performing at least one second unit operation on the fluid as it passes through the second flow path **4** in said plurality of shims **2** (see column 2, lines 49-55).

Bottcher et al. discloses that the device may be used to perform a variety of unit operations, since the device may be used as "heat exchangers, condensers, part-condensers, coolers, reactors, heat exchangers for heaters, especially condensing heaters and waste heat boilers for heat exchange in gas/gas, gas/liquid or liquid/liquid systems, and for burner designs with gaseous or liquid fuels." (see column 2, lines 50-55). In the case of a burner design, the burning of fuels would be considered an exothermic reaction. In the case of a reactor, the selection of an exothermic reaction or an endothermic reaction would have been considered a conventional design consideration for one having ordinary skill in the art. Also, "distillation" is defined as the volatilization or evaporation and subsequent condensation of a liquid, e.g., as when water is boiled in a retort and the steam is condensed in a cool receiver. Because the device is disclosed as having specific utility for the volatilization or evaporation of a liquid and condensation of a

liquid (e.g., as a boiler, condenser, part-condenser, or condensing heater), it would have been obvious for one of ordinary skill in the art at the time the invention was made to perform the unit operation of distilling using the device of Bottcher et al., if not already inherent therein. The selection of an appropriate unit operation, from the list of operations disclosed in Bottcher et al., for each of the first and second flow paths of the device, on the basis of suitability for the intended use of the process, would have been routine for one having ordinary skill in the art.

Claims 87-93

11. Claims 87-93 are rejected under 35 U.S.C. 103(a) as being unpatentable over Symonds et al. (WO 00/34728).

Regarding claims 87-93, Symonds et al. discloses a process of making a device for conducting a unit operation, comprising:

stacking a plurality of shims (e.g., perforated plates **26**, **26A** of the first type; see embodiment of FIGs. 1, 2; page 11, first paragraph, to page 13, second paragraph) such that a continuous flow path (i.e., defined by aligned slots **36**; FIG. 2) is formed through the shims;

wherein the flow path extends in a direction substantially parallel to the shim thickness (see FIGs. 1, 2); wherein the shims comprise at least three adjacent shims (e.g., four plates **26**, five plates **26A**) through which the flow path is formed; wherein a straight, unobstructed line is present through the flow path in said at least three shims (i.e., through the aligned slots **36**; see FIGs. 1, 2); wherein the flow path in said at least three shims does not mix or connect with any other flow paths (see FIGs. 1, 2); and wherein the shims are configured such that a unit operation can be performed on a fluid in the flow path in which the straight unobstructed line is present in said at least three adjacent shims (e.g., a reaction in the presence of a catalyst packed in the

pathway defined by aligned slots **36**; page 3, last paragraph; page 17, fourth paragraph); and

bonding the shims (see, e.g., page 5, third paragraph) to form the device capable of performing the unit operation on a fluid.

Symonds et al. discloses that the device may be further configured with section in which the flow path extends in a direction substantially perpendicular to the shim thickness such that, during operation, flow in said section is substantially perpendicular to the shim thickness (e.g., see additional embodiment of FIG. 10; provided with section **210** on injection plate **200**, FIG. 11; see also page 18, second to last paragraph, to page 20, fourth paragraph); wherein said section **210** comprises a header connected to plural flow paths that extend in a direction substantially parallel to the shim thickness (i.e., via the branches **212** and slots **202**, FIG. 11); and wherein said section **210** comprises a connection to an inlet **240** (see FIG. 10). It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the claimed section in the device of the Symonds et al. process, because the section would allow for the injection of additional fluids into the continuous flow path for reaction, as taught by Symonds et al.

Allowable Subject Matter

12. Claims 5 and 98 contain allowable subject matter. The prior art does not disclose or adequately suggest the instantly claimed process comprising forming of the device, wherein a first catalyst or sorbent is placed in the first flow path and a second catalyst is placed in the second flow path, the second catalyst being different than the first catalyst or sorbent.

13. Claims 13-23, 76, 85, 96, 99 and 100 contain allowable subject matter. The prior art does not disclose or adequately suggest the instantly claimed process wherein the unit operation of separating is conducted on the fluid passing through the flow path of the formed device.

14. Claims 80 and 81 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art does not disclose or adequately suggest the claimed process wherein the second flow path contains a catalyst for conducting an exothermic reaction or a catalyst for conducting an endothermic reaction as the second unit operation, and the first unit operation conducted in the first flow path is selected from the group consisting on distilling, adsorbing, separating, absorbing, and combinations thereof.

15. Claims 82 and 83 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art does not disclose or adequately suggest the claimed process wherein the first unit operation in the first flow path is selected from the group consisting of distilling, adsorbing, separating, absorbing, and combinations thereof, and the first flow path further comprises a metal film.

16. Claims 84 and 86 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action. The prior art does not disclose or adequately suggest the claimed process wherein the second flow path comprises a catalyst metal on an oxide support for conducting a second unit operation of reacting, wherein the first unit operation conducted in the first flow path is selected from the group consisting of distilling, adsorbing, separating, absorbing, and combinations thereof.

Response to Arguments

17. Applicant's arguments filed September 29, 2008 have been fully considered but they are not persuasive.

Comments regarding the rejection(s) of claims 1-4, 6-9, 75, 78, 79, 94 and 95

Applicant (at page 19, last paragraph) argues,

> "In Bottcher, heat exchange is enhanced by turbulent flow in the cross-flow channels 4. Thus, the person skilled in the art would not be motivated to modify Bottcher's devices by incorporating the features of Yamashita. Additionally, claim 1, as now amended, recites plural flow paths parallel to sheet thickness; this feature is not taught or suggested by Yamashita or the combination of Bottcher and Yamashita."

The Examiner respectfully disagrees. One having ordinary skill in the art would have been motivated to configured the apertures **7** in the device used in the process of Bottcher et al. with a circumference at least 20% populated by edge features, because the edge features would increase the surface area of the continuous flow path, and thereby increase the heat transfer efficiency of the device, as taught by Yamashita et al. (see, e.g., section [0012]).

In addition, Bottcher et al. specifically discloses plural flow paths parallel to the sheet thickness (i.e., a plurality of parallel flow paths **1** defined by apertures **7**; see FIGs. 1, 2).

Comments regarding the rejection(s) of claims 10-12 and 101

Applicant's arguments (presented at bottom of page 20 to top of page 21) have been fully considered, but they are now moot in view of the new grounds of rejection, based on the newly discovered prior art to Symonds et al. (WO 00/34728).

Comments regarding the rejection(s) of claims 24-26, 77 and 97

Applicant (at bottom of page 21 to end of page 23) argues that one of ordinary skill in the art would not have been properly motivated to modify the device in the process of Bottcher et al. to comprise microchannel dimensions.

The Examiner respectfully disagrees. One having ordinary skill in the art would have

found it advantageous to configure the channels in the device of Bottcher et al. to comprise microchannel dimensions, because the microchannel dimensions would have enabled rapid mass and heat transfer to be achieved within the device, thereby providing a higher level of reaction control and reaction manipulation, as taught by Haswell et al. (see page 389, column 2).

In response to Applicant's argument that Haswell et al. and Bottcher et al. constitute nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, both Bottcher et al. and Haswell et al. are concerned with the same problem of enhancing heat exchange in reaction devices (see Bottcher et al.: column 1, lines 28-41 and column 2, lines 50-55; see Haswell et al.: page 389, column 2).

Furthermore, one of ordinary skill in the art would have expected a device of smaller channel dimensions (and hence, smaller area A) to be inherently capable of withstanding a greater amount of pressure P than a device of larger channel dimensions (and hence, larger area A), for equal amounts of force F. Taking Applicant's recited equation, if

$F_1 = P_1 \times A_1$, $F_2 = P_2 \times A_2$, and $F_1 = F_2$,

then $\downarrow P_1 \times \uparrow A_1 = \uparrow P_2 \times \downarrow A_2$,

wherein subscript 1 represents a device having a larger channel dimension, and subscript 2 represents a device having a smaller channel dimension.

Thus, the higher operational pressures of microchannel devices would not have been surprising or unexpected to one of ordinary skill in the art.

Comments regarding the rejection(s) of claims 27-30

It is noted that no arguments were presented with respect to the rejection of claims 27-30 under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818). Therefore, the rejection has been maintained.

Comments regarding the rejection(s) of claims 87-93

Applicant arguments (at page 19, second paragraph and page 24, second paragraph) have been fully considered, but they are moot in view of the new grounds of rejection based on the newly discovered prior art to Symonds et al. (WO 00/34728).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER A. LEUNG whose telephone number is (571) 272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer A. Leung/
Primary Examiner, Art Unit 1797